SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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THE LUNAR POLAR HYDROGEN MAPPER (LUNAH-MAP) CUBESAT MISSION

Abstract

The Lunar Polar Hydrogen Mapper (LunaH-Map) is a 6U CubeSat mission selected by the NASA Science Mission Directorate as part of the Small, Innovative Missions for Planetary Exploration (SIMPLEx) program. LunaH-Map will fly as a secondary payload on the first Exploration Mission (EM-1) of the Space Launch System (SLS), scheduled to launch in July 2018. This mission is led by a small team of researchers, graduate students, and undergraduates at Arizona State University in collaboration with NASA centers, JPL, universities, and commercial space businesses.

The LunaH-Map mission will map hydrogen abundances at spatial scales below 10 km to understand how volatiles are distributed in the permanently shadowed regions of the lunar south pole. LunaH-Map's scientific payload is designed to use the scintillator material Cs_2YLiCl_6:Ce ("CLYC") in a pair of neutron detectors to measure count rates of thermal and epithermal neutrons indicating the location and abundance of hydrogen as it flies over the surface. While this detector system is being designed for LunaH-Map, it can be accommodated or modified to fit on any 6U CubeSat platform. LunaH-Map will be propelled by a low-thrust ion propulsion system to achieve lunar orbit insertion within ∼12 months of SLS separation, then maneuver into a highly elliptical, low-perilune orbit of 5-10 km centered around the south pole. Although measurements of hydrogen abundance (∼1 wt.% levels) can be detected in a single fly-by with the CubeSat-sized neutron detector being developed for LunaH-Map, the mission will achieve over 140 low-altitude fly-bys of the South Pole during its two-month science phase. LunaH-Map is designed to demonstrate that a significant scientific measurement can be achieved by a CubeSat-sized spacecraft—a high-risk, high-reward platform for enhancing planetary missions and furthering our understanding of the solar system and universe. LunaH-Map and two fellow secondary payloads selected by NASA to fly on SLS EM-1 will be the first CubeSats to explore the Moon and interplanetary space.